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Parasitic helminths of house mouse (*Mus musculus* Linnaeus, 1758) in Hungary

by
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Abstract: Taxonomical and faunistical investigations of helminths parasitizing house mouse have been carried out. Worms were collected from 590 host specimens caught at 60 different localities of Hungary. 5 species of tapeworms (488 individuals) and 6 species of nematodes (4870 individuals) were found as follows: Cestoda - *Catenotaenia pusilla*, *Hymenolepis fraterna*, *H. straminea*, *Taenia taeniaeformis* metacestoda, *Mathevotaenia symmetrica* ssp. *occidentalis*. Nematoda - *Trichocephalus muris*, *Heligmosomoides polygyrus polygyrus*, *Aspiculuris tetraptera*, *Syphacia obvelata*, *S. stroma*, *Mastophorus muris*. Three nematoda species: *Trichocephalus muris*, *Syphacia stroma*, *Mastophorus muris* are reported for the first time from *Mus musculus* in Hungary. The general prevalence of helminth infection was 50%, of which the dominant species was *A. tetraptera*.
Key words: Helminths, Cestoda, Nematoda, international review, taxonomy, faunistics, *Mus musculus*, Rodentia, Hungary

Introduction

Investigations during the past few years clarified that two species of the *Mus* genus occur in Hungary; *Mus musculus* Linnaeus, 1758 and *Mus spicilegus* Petényi, 1882 (Britton-Davidian *et al.* 1978, Bonhomme *et al.* 1984, Auffrai *et al.* 1990). At that time when the examined samples were taken the only term used was *Mus musculus spicilegus* therefore the exact identification of host animals was not possible. The difference between the two rodent species in terms of their infectionability by helminths could be a subject of further studies.

Several parasitic helminths of *Mus musculus* are cosmopolitans like their hosts, but there exist some with limited distribution. There were several studies done on the parasitic helminths of house mice (see Table 1).

Hungarian literature consists mainly of the studies written by authors working in the Parasitological Collection of the Hungarian Natural History Museum. Kassai & Mészáros (1968) worked on parasitic helminths of animal houses in Budapest, Mészáros *et al.* (1981) reported on helminths of Hortobágy National Park, Murai *et al.* (1985) of Kiskunság National Park. *Mathevotaenia symmetrica* was first found by Murai (1974) in Hungary. The found specimens were described as a new subspecies called *M.s. occidentalis*. European and Middle Asian parasites of house mice are summarized in Table 1.

Table 1. Helminth parasites of *Mus musculus* in present paper and by European authors.

Species	H	D	GB	F	E	BG	RO	MOL	UKR	PL	CS	SU
Trematoda												
Brachylaemus aequans						+						+
Brachylaemus sp.					+							
Corrigia vitta						+						
Lecithodendriidae sp.					+							
Plagiorchis maculosus									+			+
P. elegans							+					+
Plagiorchis sp.												+
Psilotrema simillimum						+						
Cestoda												
Catenotaenia pusilla	+				+	+	+	+	+	+		+
Hymenolepis diminuta		+			+	+	+		+			+
H. fraterna	+	+			+	+					+	
H. straminea	+				+			+	+		+	+
Mesocestoides lineatus					+		+	+				+
Taenia mustelae						+						
T. taeniaeformis	+	+			+	+	+	+	+	+		+
Tetratirotaenia polyacantha						+		+				+
Echinococcus multilocularis								+				+
Mathevotaenia symmetrica	+							+	+			+
Nematoda												
Hepaticola hepatica					+							+
Trichinella spiralis					+			+	+			+
Trichocephalus muris	0	+	+		+	+	+	+	+	+		+
Heligmosomum aberrans								+				
Heligmosomoides polygyrus	+				+	+	+	+				+
Nippostrongylus brasiliensis					+							
Ganguleterakis spumosa		+			+	+			+			+
Ganguleterakis sp.									+			
Aspiculuris schulzi								+	+			+
A. tetraptera	+	+	+	+	+	+	+	+	+	+		+
Syphacia obvelata	+	+	+	+	+	+		+	+	+		+
S. stroma	0											+
Gongylonema neoplasticum					+		+					+
Mastophorus muris	0	+			+	+		+	+	+		+
Acanthocephala												
Moniliformis moniliformis								+				+

Legend: + = species known from literature data; 0 = species new to the Hungarian *Mus musculus*, present paper; **H** = Hungary: Kassai & Mészáros (1968), Murai (1974), Mészáros *et al.* (1981), Murai *et al.* (1985), Murai (1989), present paper (n = 590); **D** = Germany: Schmidt (1961), (n = 106); **GB** = Great Britain: Fahmy (1954), Behnke & Wakelin (1973), Behnke (1975) (n = 102); **F** = France: Lukasiak (1954), Behnke (1975); **E** = Spain: Feliu (1980); Feliu *et al.* (1985) (n = 376); **BG** = Bulgaria: Genov (1984) (n = 627); **RO** = Roumania: Popescu *et al.* (1974), Mészáros & Murai (1979) (n = 379); **MOL** = Moldavia: Andreiko (1973) (further uncertain helminth species Cestoda: 3, Nematoda: 2); **UKR** = Ukraina: Sharpilo (1966); **PL** = Poland: Lukasiak (1954), Furmaga (1957) (n = 154); **CS** = former Czechoslovakia: Baer & Tenora (1970); **SU** = former Soviet Union: Rizhikov (1978, 1979) (further uncertain helminth species Cestoda: 14, Nematoda: 16).

Materials and methods

This study is based on the collection of parasitic helminths of *Mus musculus* which have been collected since 1965 in the Parasitological Collection of the Zoological Department of the Hungarian Natural History Museum. The host animals were collected in various localities of Hungary by the parasitological staff and mammalogists of the Hungarian Natural History Museum (Gábor Csorba, András Demeter, András Gubányi, István Matskási, Ferenc Mészáros, Éva Murai, István Szabó, György Topál); 129 mice specimens originate from the Buda Hills (Nagykovácsi), and were captured with living traps for helminthological investigations by Lajos Zombori, hymenopterologist. Some other institutions such as Pannon Agricultural University Keszthely and some collectors such as Béla Edelényi, József Rékási, Ottó Sey also presented some individuals. These materials were completed with my own collections from areas where there had been no collections before (Mátra Mts and Somogy county). Altogether 590 host animals were collected from 60 localities (see Fig.1), from these 488 tapeworms and 4870 nematode specimens were found. The mice were trapped either by pitfall traps or by living traps. In the case of the latter method animal were killed with chloroform. The animals were dissected and the intestines and body cavities were examined. The dissections and the stained tapeworm preparations were made by Mrs Etelka Vajda. The nematodes were fixed in hot Barbagallo (2.5% formalin) solutions while the tapeworms were fixed and preserved by using 5% formalin solution. The nematodes were translucenced in lactophenol. Whole mount preparation of tapeworms were stained with acetic carmine or Ehrlich's haematoxylin. Rostellar hooks and eggs were studied in Berlese solution. Cestodes were identified according to the papers of Genov (1984) and Schmidt (1986), while the nematodes according to the papers and systems of Genov (1984) and Yamaguti (1961).

Results

Cestoda

Catenotaeniidae Spassky, 1950

Catenotaenia pusilla (Goeze, 1782) Janicki, 1904

Syn.: *Taenia pusilla* Goeze, 1782

Intermediate hosts: mites

Localization: small intestine

Geographical distribution: Europe, Asia, Africa, North America

Description: Body length 90-160 mm, maximum width 1-1.65 mm. Diameter of scolex 0.2-0.3 mm, of suckers 0.08-0.10 mm. Number of testes 70-75. Uterus with 11-12 lateral branches on each side. Cirrus sac 0.220 x 0.055 mm. Seminal receptacle 0.140 x 0.090 mm. Eggs ovoid 0.035 x 0.021 mm. Oncosphere 0.018 x 0.013.

Localities: **2.*** Kapuvár, five cases, April; **6.** Bakonynána, one case, July, Németbánya, three cases, July, five cases, August, one case, October, Vadászvölgy, one case, August, Nagyvázsony, one case, May; **7.** Fonó, two cases, November; **10.** Nagykovácsi, one case, January, one case, July, two cases, September; **11.** Óbuda, one case, June, Pestlőrinc, one case, August; **13.** Kosd, five cases, April; **14.** Gyöngyös, one case, August; **15.** Orgovány, one case, September; **19.** Nagyiván, one case, September; **20.** Tákos, four cases, November.

6.6 percent of the host population was infected by *C. pusilla*, the intensity of infection was 2.7. The levels of prevalence by seasons were: 1.6% in winter, 11.8% in spring, 13.7% in summer and 3.0% in autumn.

* The numbers refer to the localities given in Fig. 1.

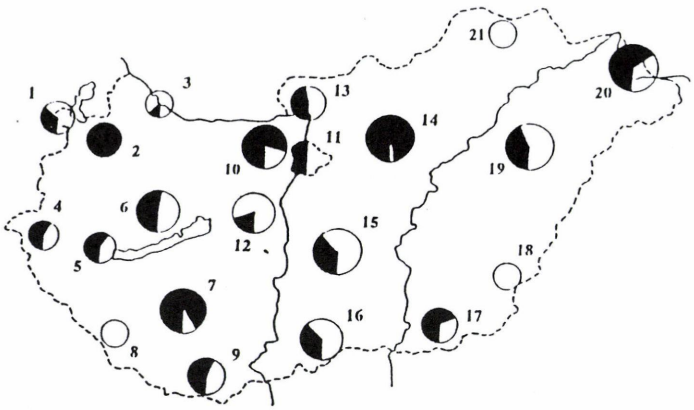

Fig. 1: Collecting localities of house mouse in Hungary (black parts of the circles show the rate of infection)

Legend: **1**. Sopron Mts: Fertőrákos examined 1/infected 1, Fertőújlak 2/0, Sopron Pinty-tető 1/0; **2**. Hanság: Kapuvár 15/15; **3**. Szigetköz: Patkányos 16/3; **4**. Őrség: Szalafő 6/3; Tanakajd 1/1; **5**. Keszthely Bay 19/10; **6**. Bakony Mts - Balatonfelvidék: Bakonynána, Farkasgyepü, Kisszépalmapuszta, Németbánya, 44/20, Balatoncsicsó, Nagyvázsony 9/6; **7**. Somogy : Fonó 26/21; **8**. South Somogy: Szabás 1/0; **9**. Baranya Hills: Aranyosgadány 9/5; **10**. Buda and Pilis Hills: Nagykovácsi 129/92, Érd 3/2, Pilisborosjenő 2/0; **11**. Budapest 41/21; **12**. Mezőföld: Szigetbecse 4/0, Agárd, Zámoly 19/5; **13**. Börzsöny Mts - Naszály - Gödöllő Hills: Királyháza 2/0, Vác, Kosd, Vácrátót 45/17, Babat 19/3; **14**. Mátra Mts: Gyöngyös 23/21; **15**. Kiskunság National Park: Orgovány, Fülöpháza, Kondor Lake, Ágasegyháza, Szelidi Lake, 72/21; **16**. Bácsalmás, Madaras, Tataháza 45/12; **17**. Maros basin: Földeák, Rákos 2/1; **18**. Körös basin: Gyula, Sarkad 3/0; **19**. Hortobágy National Park: Ohat, Nagyiván 11/4; **20**. Bereg lowland: Tákos 18/11; **21**. Hernád basin: Méra 2/0

Hymenolepididae Railliet et Henry, 1909

Hymenolepis fraterna (Stilles, 1906)

Syn.: *Hymenolepis nana* Siebold, 1852; *Vampirolepis nana* (Siebold, 1852) Spassky, 1954

Intermediate hosts: fleas (Siphonaptera), beetles (Coleoptera) or without intermediate host

Localization: small intestine

Geographical distribution: cosmopolitan

Description: Body length 12-120 mm, maximum width 0.3-1.3 mm. Diameter of scolex 0.15-0.28 mm, of suckers 0.05-0.07 mm (Fig. 11). Number of hooks 18-25, 0.016-0.018 mm. Testes situated in a line one poral, two aporal. Cirrus sac 0.056-0.083 mm. Eggs spherical, 0.045-0.058 mm. Oncosphere 0.029-0.031 mm, embryonal hooks 0.012-0.014 mm.

Localities: **6.** Németbánya, one case, August; **10.** Nagykovácsi, one case, September; **16.** Bácsalmás, three cases, October, one case, November; **20.** Tákos, one case, November.

1.0 percent of the host population was infected by *H. fraterna*, the intensity of infection was 5.2. The levels of prevalence by seasons were: 0.0% in winter, 0.0% in spring, 1.0% in summer and 1.5% in autumn.

Hymenolepis straminea (Goeze, 1782)

Syn.: *Hymenolepis microstoma* (Duj., 1845) Blanchard, 1891; *Rodentolepis straminea* (Goeze, 1782) Spassky, 1954 pro parte;

Intermediate hosts: beetles (Tenebrionidae, Scarabeidae)
Localization: small intestine
Geographical distribution: Palaearctic
Description: Body length 70-110 mm, maximum width 1.6-2.4 mm. Diameter of scolex 0.19-0.28 mm, of suckers 0.070-0.089 mm (Fig. 10). Rostellum 0.09 x 0.06 with 20-24 hooks measuring 0.013-0.016 mm. Testes form a triangle, one situated poral, two aporal. Cirrus sac 0.08-0.19 mm. Eggs ovoid, 0.055-0.076 x 0.040-0.055. Oncosphere 0.03 mm, embryonal hooks 0.016-0.018 mm.
Localities: **10.** Nagykovácsi, one case, March, one case, April, one case, May, one case, September, one case, December; **14.** Gyöngyös, four cases, August; Gyöngyöshalász, one case, August.
2.4 percent of the host population was infected by *H. straminea*, the intensity of infection was 8.0. The levels of prevalence by seasons were: 1.5% in winter, 3.9% in spring, 4.9% in summer and 1.2% in autumn.

Taeniidae Ludwig, 1886

Taenia taeniaeformis Batsch, 1786 – metacestodes
Syn.: *Hydatigera taeniaeformis* Batsch, 1786; *Strobilocercus fasciolaris* Rudolphi, 1808;
Hosts: *Felis catus domesticus*, *Felis silvestris*
Intermediate hosts: *Mus musculus*
Localization in the intermediate host: surface of the liver
Geographical distribution: cosmopolitan
Description: Oval cysticercus 3-12 mm in diameter. Pseudostrobila 20-125 mm, maximum width 3-6 mm. Diameter of suckers 0.34-0.49 mm. Scolex with double circle of hooks. Number of hooks 30-36, 0.26-0.28 mm the small ones and 0.43-0.48 mm the largest.
Localities: **4.** Tanakajd, one case, September; **6.** Németbánya, one case, July, Balatoncsicsó, one case, May, Nagyvázsony, two cases, May; **7.** Fonó, six cases, September, four cases, November; **10.** Nagykovácsi, two cases, January, three cases, February, two cases, March, one case, April, one case, May, one case, June, one case, August, five cases, September, seven cases, October, six cases, November, one case, December, Érd, two cases, February; **11.** Budapest, one case, October, Csillaghegy, one case, November, Óbuda, one case, June, Pestlőrinc, one case, March, Budakeszi, two cases, May, one case, September; **13.** Kosd, nine cases, April; **14.** Gyöngyös, two cases, August, Gyöngyössolymos, two cases, August; **15.** Orgovány, three cases, September, Fülöpháza, one case, November, Kondor Lake, one case, February, Ágasegyháza, one case, August; **17.** Rákos, one case, December; **19.** Nagyiván, one case, September, **20.** Tákos, one case, November.
13.4 percent of the host population was infected by *T. taeniaeformis*, the intensity of infection was 1.2. The levels of prevalence by seasons were: 18.7% in winter, 18.6% in spring, 7.8% in summer and 12.4% in autumn.

Linstowiidae (Mola, 1929) Spassky, 1949

Mathevotaenia symmetrica (Baylis, 1927) ssp. *occidentalis* Murai, 1974
Syn.: *Catenotaenia symmetrica* Baylis, 1927; *Oochoristica ratti* Yamaguti et Miyata, 1937
Intermediate hosts: beetles (Coleoptera)
Localization: small intestine

Geographical distribution: Europe, Asia, North America; the taxonomical and geographical status of *M. s.* ssp. *occidentalis* Murai, 1974 need further investigations.

Description: Body length 80-200 mm, maximum width 2-3.5 mm. Diameter of scolex 0.32-0.37 mm, of suckers 0.10-0.12 mm. Number of testes 37-70. Ovary 0.3-0.4 mm, vitellary gland 0.12-0.13 mm in diameter. Eggs spherical or elliptical, 0.040-0.060 mm in diameter. Oncosphere 0.035-0.040 mm, lenght of embryonal hooks 0.014-0.016 mm.

Localities: **10.** Nagykovácsi, two cases, January, two cases, February, one case, March, one case, June, one case, August, two cases, September, two cases, October, three cases, November; **11.** Budapest, one case, October, Óbuda, one case, June, Pestlőrinc, one case, August; **14.** Gyöngyös, two cases, August; Gyöngyöshalász, two cases, August.

3.5 percent of host population was infected by *M. symmetrica*, the intensity of infection was 6.9. The levels of prevalence by seasons were: 6.4% in winter, 1.0% in spring, 6.9% in summer and 2.7% in autumn.

Nematoda

Trichocephalidae Baird, 1853

Trichocephalus muris Schrank, 1788

Syn.: *Trichuris muris* (Schrank, 1788) Hall, 1916

Localization: caecum, large intestine

Geographical distribution: cosmopolitan

Description:

Male: Body length 14-27 mm, maximum width 0.25-0.52 mm. Esophagus length 8.8-18.7 mm. Spiculum 0.57-0.73 mm long (Fig. 2).

Female: Body length 14.6-36.5 mm, maximum width 0.4-0.6 mm. Esophagus length 9.6-20.7 mm. Distance of vulva 9.6-17.1 mm from anterior end. Anus 0.15-0.20 mm from posterior end. Eggs barrel-shaped 0.059-0.066 x 0.028-0.034 mm (Fig. 3).

Localities: **2.** Kapuvár, two cases, April; **6.** Farkasgyepü, two cases, November, Nagyvázsony, one case, May; **7.** Fonó, seven cases, September, four cases, November; **9.** Aranyosgadány, one case, October; **10.** Nagykovácsi, one case, January, two cases, February, one case, March, two cases, April, one case, May, one case, June, one case, July, one case, August, two cases, September, four cases, October, five cases, November, two cases, December; Érd, one case, February; **11.** Nagytétény, two cases, September, Óbuda, three cases, June; **14.** Gyöngyöshalász, one case, August; **16.** Bács County, one case, October; **17.** Rákos, one case, December.

8.5 percent of the host population was infected by *T. muris*, the intensity of infection was 7.2. The levels of prevalence by seasons were: 11.3% in winter, 6.8% in spring, 5.9% in summer and 9.3% in autumn.

Heligmosomidae Cram, 1927

Heligmosomoides polygyrus polygyrus (Dujardin, 1845) Railliet et Henry, 1909

Syn.: *Nematospiroides dubius* Baylis, 1926; *Heligmosomum azerbaidjani* Schachnazarova, 1949

Localization: small intestine

Geographical distribution: Europe, Asia, North America

Description:

Male: Body length 4.5-7.2 mm, maximum width 0.078-0.125 mm (Fig. 9). Esophagus length 0.36-0.46 mm. Nerve ring 0.164-0.270 mm, excretory pore 0.184-0.340 mm from anterior end. Bursa copulatrix asymmetrical. Spicules 0.52-0.65 mm long (Fig. 8). Gubernaculum absent.

Female: Body length 8.3-14.6 mm, maximum width 0.12-0.19 mm. Esophagus length 0.48-0.65 mm. Nerve ring 0.24-0.3 mm, excretory pore 0.36-0.48 mm from anterior end. Distance of vulva 0.24-0.35 mm, that of anus 0.09-0.14 mm from posterior end. Tail with terminal spike (Fig. 4).

Localities: **5.** Keszthely Bay, four cases, April; **6.** Németbánya, one case, October, Nagyvázsony, one case, June; **9.** Aranyosgadány, one case, October; **10.** Nagykovácsi, two cases, January, three cases, February, one case, March, two cases, April, two cases, May, two cases, September, four cases, October, nine cases, November, three cases, December; **11.** Budapest, one case, February, one case, October, one case, December, Óbuda, four cases, June; **12.** Agárd, two cases, July, one case, September, Zámoly, one case, October; **14.** Gyöngyös, three cases, August; **15.** Orgovány, one case, September, Fülöpháza, one case, July, Szelidi Lake, one case, June, Ágasegyháza, three cases, August; **16.** Bácsalmás, one case, December; **19.** Nagyiván, one case, September.

10.8 percent of the host population was infected by *H. polygyrus*, the intensity of infection was 11.3. The levels of prevalence by seasons were: 19.3% in winter, 8.8% in spring, 16.6% in summer and 8.3% in autumn.

Oxiuridae Cobbold, 1864

Aspiculuris tetraptera (Nitzsch, 1821) Schulz, 1924

Syn.: *Aspiculuris kazakhstanica* Nasarova et Sweschnikova, 1930; *Ascaris tetraptera* Nitzsch, 1821

Localization: caecum, large intestine, rectum

Geographical distribution: Europe, Asia, North America, Africa

Description:

Male: Body length 2.86-3.35 mm, Maximum width 0.18-0.22 mm. Esophagus length 0.375-0.392 mm.

Female: Body length 4.11-4.62 mm, maximum width 0.27-0.32 mm. Esophagus length 0.43-0.47 mm. Nerve ring 0.12-0.16 mm from anterior end. Distance of vulva 2.49-2.61 mm from posterior end. Eggs ovoid 0.080-0.090 x 0.040-0.044 mm (Fig. 7).

Localities: **2.** Kapuvár, four cases, April; **4.** Szalafő, two cases, September; **6.** Farkasgyepü, one case, November, Németbánya, four cases, July, five cases, August, Nagyvázsony, two cases, May; **7.** Fonó, nine cases, September, eleven cases, November; **9.** Aranyosgadány, one case, July, one case, August; **10.** Nagykovácsi, two cases, January, three cases, February, four cases, March, one case, August, four cases, September, six cases, October, three cases, November, two cases, December; **11.** Budapest, one case, February, one case, October, Óbuda, three cases, June; **12.** Agárd, one case, July, one case, September; **13.** Vác, one case, March, Kosd, six cases, April, Babat, one case, September, one case, October, one case, November; **14.** Gyöngyös, three cases, August, Gyöngyöshalász, seven cases, August, Gyöngyössolymos, two cases, August; **15.** Orgovány, one case, September, Ágasegyháza, one case, October, Szelidi-tó, one case, October;

16. Bács county, one case, October, Bácsalmás, one case, September, Madaras, one case, October; **20.** Tákos, seven cases, November.

18.3 percent of host population was infected by *A. tetraptera*, the intensity of infection was 25.3. The levels of prevalence by seasons were: 14.5% in winter, 17.6% in spring, 28.4% in summer and 16.0% in autumn.

Syphacia obvelata (Rudolphi, 1802) Rauther, 1930

Syn.: *Ascaris vermicularis muris* (Fröhlich, 1791) Dujardin, 1845

Localization: coecum, large intestine

Geographical distribution: cosmopolitan

Description:

Male: Body length 0.85-1.6 mm, maximum width 0.10-0.18 mm Esophagus length 0.18-0.24 mm. Nerve ring 0.08-0.11 mm, excretory pore 0.17-0.35 mm from anterior end. Spiculum 0.6-0.7 mm long.

Female: Body length 3.04-4.81 mm, maximum width 0.24-0.30 mm. Esophaegus 0.315-0.394 mm long. Nerve ring 0.148-0.167 mm, excretory pore 0.355-0.473 mm, vulva 0.582-0.690 mm from anterior end. Eggs ovale 0.134-0.140 x 0.036-0.040 mm (Fig. 6).

Localities: **1.** Fertőrákos, one case, August; **2.** Kapuvár, five cases, April, Hanság, one case, October; **5.** Keszthely Bay, seven cases, October; **6.** Farkasgyepü, three cases, November, Németbánya, one case, November, Balatoncsicsó, two cases, May; **9.** Aranyosgadány, one case, October; **10.** Nagykovácsi, two cases, March, one case, September, one case, October, one case, November, one case, December; **11.** Nagytétény, one case, September; **12.** Agárd, one case, July; **14.** Gyöngyös, one case, August; **16.** Bács m., one case, October, Bácsalmás, two cases, October, two cases, November; **19.** Nagyiván, one case, September.

5.4 percent of host population was infected by *S. obvelata*, the intensity of infection 20.3. The levels prevalence by seasons were: 1.6% in winter, 9.8% in spring, 3.9% in summer and 5.2% in autumn.

Syphacia stroma (Linstow, 1884)

Localization: small intestine

Geographical distribution: Europe, Asia

Description:

Male: Body length 1.50-1.95 mm, maximum width 0.140-0.163 mm. Esophagus length 0.280-0.345 mm. Nerve ring 0.12-0.15 mm, excretory pore 0.42-0.54 mm from anterior end. Spiculum 0.076-0.088 mm long.

Female: Body length 2.47-3.70 mm, maximum width 0.25-0.29 mm. Esophagus length 0.30-0.41 mm. Nerve ring 0.12-0.17 mm, excretory pore 0.38-0.58 mm, vulva 0.71-0.99 mm from anterior end. Eggs ovoid 0.132-0.144 x 0.041-0.043 mm.

Localities: **5.** Keszthely Bay, one case, April.

0.2 percent of the host population was infected by *S. stroma*, the level of infection was 205.0.

Spiruridae Örley, 1885

Mastophorus muris (Gmelin, 1790)

Syn.: *Ascaris muris* Gmelin, 1790

Intermediate hosts: fleas (Siphonaptera), cockroaches (Blattaria), beetles (*Geotrupes*)

Localization: stomach

Geographical distribution: cosmopolitan

Description:

Male: Body length 12.5-25.0 mm, maximum width 0.29-0.80 mm. Esophagus length 2.065-2.510 mm. Excretory pore 0.25-0.41 mm from anterior end. Distance of anus 0.15-0.23 mm from posterior end. Spicules unlike 0.54-1.05 x 0.019-0.024 mm the small ones and 1.11-1.22 x 0.036-0.040 mm the largests.

Female: Body length 17.5-47 mm, maximum width 0.34-2.00 mm. Esophagus 3.00-5.183 mm. Vulva 4.80-15.00 from anterior end. Distance of anus 0.30-0.64 mm from posterior end. Eggs ovoid 0.051-0.062 x 0.033-0.036 mm (Fig. 5).

Localities: **4.** Szalafő, one case, September; **6.** Nagyvázsony, one case, May; **9.** Aranyosgadány, one case, July; **14.** Gyöngyös, one case, August; **20.** Tákos, one case, November.

1.2 percent of the host population was infected by *M. muris*, the intensity of infection was 10.6. The levels of prevalence by seasons were: 0.0% in winter, 1.0% in spring, 3.9% in summer and 0.6% in autumn.

Discussion

295 of 590 examined specimens were infected by helminths (50%). Neither susceptibility of all helminths nor of single helminth species did vary by the sex of the host. 11 helminth species were found alltogether, 5 of them are tapeworms 6 of them nematode. 8 helminth species are considered to be common parasites of house mice, while *Trichocephalus muris, Syphacia stroma* and *Mastophorus muris* were new ones. *S. stroma* was recorded from house mice only once by Russian authors, but this record is not perfectly reliable. The fact that the helminths were preliminarly prepared and it was not possible to check the host animals lead us to conclude that there is a need for further investigations. Data of infection of house mouse are summarized in Tables 2-3.

Table 2. Prevalence and intensity of helminth infection in the Hungarian mouse population

Species	Host n	Infected n	Helminth n	Infestation prev.%	int.
C. pusilla	590	39	106	6.6	2.7
H. fraterna	590	6	31	1.0	5.2
H. straminea	590	14	112	2.4	8.0
T. taeniaeformis	590	79	95	13.4	1.2
M. symmetrica	590	20	144	3.4	6.9
T. muris	590	50	358	8.5	7.2
H. polygyrus	590	64	735	10.8	11.3
A. tetraptera	590	108	2850	18.3	25.3
S. obvelata	590	32	648	5.4	20.3
S. stroma	590	1	205	0.2	205.0
M. muris	590	7	74	1.2	10.6

Table 3. Seasonal fluctuation of infection

Species	Winter* n=62 prev.%	int.	Spring n=102 %	int.	Summer n=102 %	int	Autumn n=324 %	int.
C. pus.	1.6	1.0	11.8	3.0	13.7	3.9	3.0	1.2
H. fra.	0.0	0.0	0.0	0.0	1.0	2.0	1.5	5.8
H. str.	1.5	9.0	3.9	8.7	4.9	5.6	1.2	10.0
T. tae.	18.7	1.2	18.6	1.2	7.8	3.9	12.4	1.1
M. sym.	6.4	2.0	1.0	5.0	6.9	10.3	2.7	7.4
T. mur.	11.3	21.0	6.8	4.4	5.9	3.8	9.3	5.2
H. pol.	19.3	7.8	8.8	7.2	16.6	23.8	8.3	5.9
A. tet.	14.5	15.4	17.6	25.8	28.4	39.9	16.0	20.9
S. obv.	1.6	29.0	9.8	18.2	3.9	22.0	5.2	20.5
S. str.	0.0	0.0	1.0	205	0.0	0.0	0.0	0.0
M. mur.	0.0	0.0	1.0	3.0	3.9	6.0	0.6	23.5

* seasons are calculated by meteorological scheme

Apparently prevalence level of *Syphacia obvelata* is found to be lower than that of found in the literature. During the present study 5.4% prevalence was found while in Bulgaria 8.2 (Genov 1984) in France 52.6, in Poland 53.7, in Italy 58% (see Lukasiak 1954 for review) prevalence levels were found, at the same time other species showed only 1-2% prevalence there. In Hungary *Aspiculuris tetraptera* seemed to replace this species.

Most of the species independently from their infection strategy were found to have spring-summer infection peak. This can be induced by the intensiveness of varying population size and age distribution of host populations during the spring period. In the case of *C. pusilla* and *A. tetraptera* both prevalence and infection levels show a summer peak.

Some other species, *Taenia taeniaeformis, Mathevotaenia symmetrica* and *Trichocephalus muris*, however, have a winter peak as well, infecting those immature host specimens, which survived the autumn mortality.

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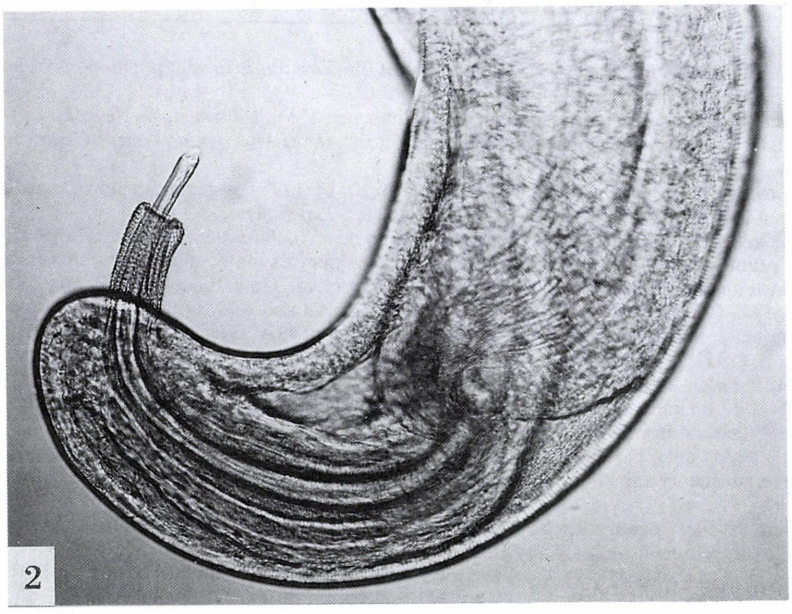
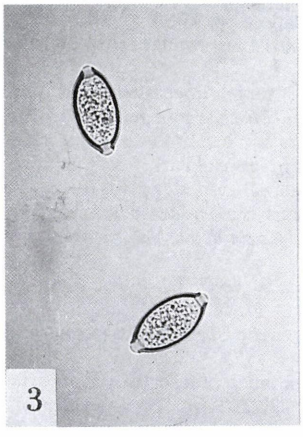
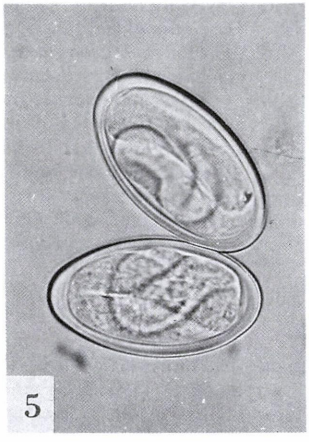






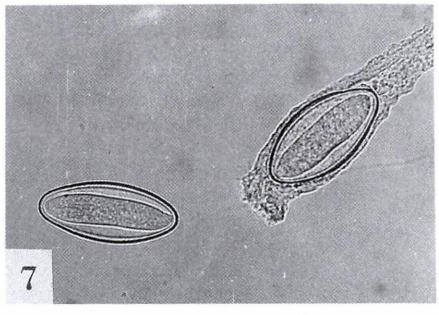
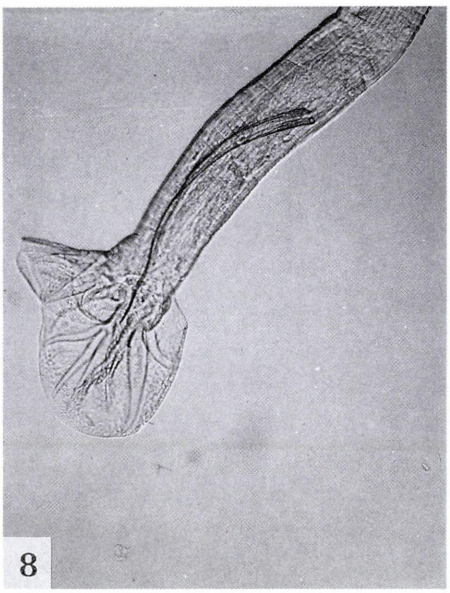
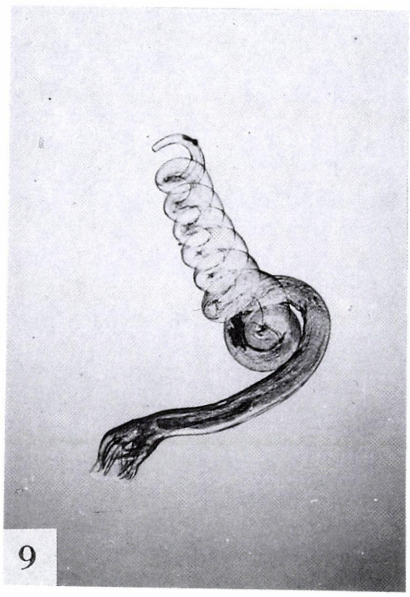
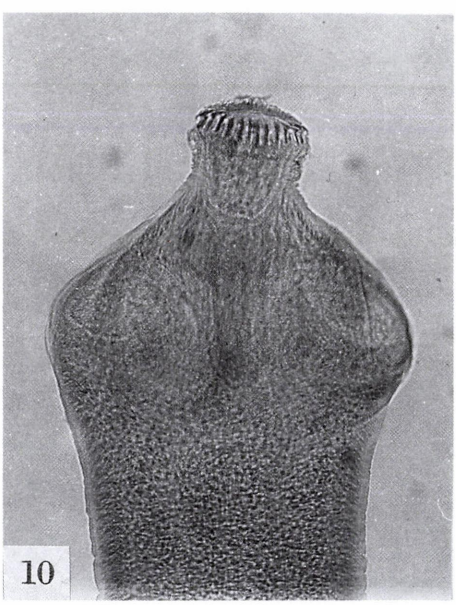


Fig. 2. Tail end of male *T. muris*, lateral view
Figs 3-7. Eggs. 3 = *T. muris*, 4 = *H. p. polygyrus*, 5 = *M. muris*, 6 = *S. obvelata*, 7 = *A. tetraptera*







Figs 8-9. *Heligmosomoides polygyrus polygyrus*. 8 = Bursa copulatrix, 9 = Habitus of male
Fig. 10. Scolex of *H. straminea*
Fig. 11. Scolex of *H. fraterna*
Measurements see in text
(author's photo)